REMARKS

In the Office Action dated June 29, 2009, the Examiner rejects claims 1-30 under 35 U.S.C. §103(a). With this Amendment, claims 1-5, 9-11, 13-15, 18-20, 22, 23, 25, 26, 28 and 29 are amended. No claims are added or canceled. After entry of this Amendment, claims 1-30 are pending in the Application. Reconsideration of the Application as amended is respectfully requested.

In the Office Action dated July 29, 2009, the Examiner rejects claims 1-30 under 35 U.S.C § 103(a) as being unpatentable over Sasaki et al. (US 6,466,684) in view of Furukawa et al. (US 2005/0152580). Sasaki et al. was previously cited, but Furukawa et al. is newly-cited.

Applicant thanks the Examiner for conducting a telephonic interview with the undersigned on September 9, 2009. Applicant beforehand presented a detailed discussion as to the deficiencies in each of the Examiner's rejections to claims 1-4, 6, 7 and 9, but discussion during the teleconference was limited to claims 1, 3, 5 and 9. With respect to claim 1, Applicant pointed out in response to the Office Action dated December 11, 2008 that Sasaki et al. fails to teach or suggest at least the feature of claim 1 (and a similar feature in each of independent claims 10, 19 and 25) of computing a velocity information for <u>each</u> pixel in the image. The Examiner again stated Sasaki et al. taught this feature in the Office Action dated June 29, 2009, without addressing Applicant's citations to Sasaki et al. and without providing any citation to Sasaki et al. for the feature. Applicant gratefully appreciates the Examiner indicating that she believes Sasaki et al. teaches this feature at col. 13, ll. 10-55. Applicant expressed their disagreement with this position and discusses this further herein.

With respect to claim 3, Applicant requested clarification as to how the Examiner considered Sasaki et al. to teach the feature therein of judging that oblique lines in the image are road boundaries when respective slopes of the oblique lines decrease from a center of the image toward an outside of the image. The Examiner directed Applicant's attention to FIGS. 8A and 8B. Applicant agreed that sloped lines were shown but disagreed that this taught or suggested the <u>claimed</u> features.

The Examiner suggested perhaps amending the claim language to describe grouping of the pixels by velocity using language similar to the language in claim 5 to

distinguish Sasaki et al.

Finally, Applicant asked the Examiner about the rejection of claim 9, repeating the facts presented in response to the Office Action dated December 11, 2008 that the word "brake" is never used in Sasaki et al., and "braking" is described only in the context of describing action by another driver that might cause a collision. (Col. 1, line 25). Therefore, and contrary to the Examiner's position, Sasaki et al. does not teach or suggest an automatic braking device operatively coupled to the controller and activated by the collision danger signal. The Examiner directed Applicant's attention to col. 18, ll. 29-37, cited in the Office Action. The undersigned pointed out that section did not discuss braking at all. The Examiner agreed that the cited section of Sasaki et al. did not discuss braking. The undersigned had understood the Examiner to agree that claim 9 was allowable over the cited combination, but the Examiner's Interview Summary does not mention this matter.

In the Office Action dated July 29, 2009, the Examiner rejects claims 1-30 under 35 U.S.C § 103(a) as being unpatentable over Sasaki et al. (US 6,466,684) in view of Furukawa et al. (US 2005/0152580). The Examiner's citations to Sasaki et al. remain unchanged, and the same deficiencies occur in Sasaki et al. as described in the previous Office Action. The Examiner does not attempt to cure the deficiencies in Sasaki et al. previously noted by Applicant with Furukawa et al. and cannot in any event. Nonetheless, Applicant has amended each of the independent claims in an attempt to further prosecution in this Application.

Namely, claim 1 now describes a controller that computes velocity information for each pixel in an image using a sequential series of images, extracts those pixels having a velocity component based on the velocity information, wherein the velocity component comprises a movement direction and a movement velocity in a lateral direction, define regions for detecting a road boundary, detects oblique lines based on grouping those extracted pixels having a velocity component in the regions, and generates a signal indicative of a road boundary in the image based on the oblique lines. Similar amendments are made to the other independent claims. Applicant respectfully submits that the recited combination fails to teach or suggest all the features of independent claims 1, 10, 19 and 25 and their dependent claims.

Applicant submits that, among other deficiencies, the recited combination fails to teach or suggest a feature where velocity information for <u>each</u> pixel in an image is computed using a sequential series of images and then using that information to extract pixels that are later used to detect oblique lines. The Examiner cited col. 13, ll. 10-55 of Sasaki et al. for teaching the computation of velocity information for each pixel in an image. However, that section of Sasaki et al. expressly only describes an optical flow detecting method for only a <u>portion</u> of the pixels as shown in FIG. 12. (Col. 14, ll. 3-10). Sasaki et al. states that "the pixels whose optical flows <u>should not</u> be detected are removed to the maximum degree, and only the pixels constituting the forward vehicle to be detected are extracted." The monitoring range is defined by the road lane as shown in FIG. 12, which is defined before <u>any</u> optical flow is calculated. In other words, the road lane <u>is already known</u> when the process described in FIG. 13, col. 13, ll. 10-55 is performed. Sasaki et al. uses the road edges to <u>narrow</u> the search region for objects to minimize the velocity information that must be calculated. (FIGS. 13, 14A-14I, 19; col. 14, ll. 8-20 and 41-48).

Sasaki et al., alone or in combination with Furukawa et al., fails to teach or suggest the features above. In addition, the recited combination fails to teach or suggest detecting oblique lines based on (or by) grouping those extracted pixels having a velocity component in defined regions for detecting a road boundary. As described in detail in the last Office Action, Sasaki et al. essentially compares a virtual focus of expansion (FOE) for a number of candidate lines over time to determine which of the candidate lines define the road lane. Furukawa et al. also fails to teach or suggest this feature.

For all of the foregoing reasons, independent claims 1, 10, 19 and 25 and their dependent claims are allowable over the cited references.

Applicant further submits that the cited art, either alone or in any permissible combination, fails to teach or suggest features of claims dependent from claims 1, 10, 19 and 25.

With respect to dependent claims 2, 11, 20 and 26, for example, Applicant respectfully submits that the Examiner fails to make a *prima facie* case of obviousness. Nonetheless, Applicants have amended these claims to more particularly point out and distinctly claim the invention. Claim 2 recites that the controller judges that oblique lines in

the image are road boundaries when the vehicle is traveling and the oblique lines are positioned on the image with bilateral symmetry and respectively comprise pixels having velocity components with different movement directions. Similar changes are made in claims 11, 20 and 26. Applicant respectfully submits that no movement direction for either line in Sasaki et al. is calculated or used in a determination of whether detected oblique lines are road boundaries. The Examiner cites col. 8, ll. 6-11, but all this section says is that two successive images are taken. (Office Action, p. 4). As described above, optical flow of pixels (that is, the change over time) in Sasaki et al. is not computed until <u>after</u> the road lane is already detected by the FOE method.

Similarly, and with respect to dependent claims 3, 12, 21 and 27, slopes of the oblique lines are not determined in Sasaki et al. (Office Action, p. 5). In the Examiner interview, the Examiner pointed to FIGS. 8A and 8B. However, these figures merely illustrate how candidate lines are selected based on the FOE. (Col. 11, ll. 5-13). The actual determination of whether the candidate lines are road boundaries occurs in subsequent steps in Sasaki et al. Furukawa et al. fails to teach or suggest this feature in combination with Sasaki et al.

While pitch is mentioned in Sasaki et al., no change point as described in claims 4, 13, 22 and 28 is taught or suggested. Nonetheless, Applicant has amended these claims to more particularly point out and distinctly claim the invention. For example, claim 4 recites that the controller detects a change point where a velocity direction of a detected oblique line changes from one image to a subsequent image and judges that the change point is a pitching balance point where a line of sight orientation of the image pickup device is horizontal with respect to a road surface. Similar features are described in claims 13, 22 and 28. The recited combination fails to teach or suggest these features. The velocity direction of an oblique line is never calculated in Sasaki et al. Nor is such a change judged to be a pitching balance point therein. Pitch angle in Sasaki et al. is mentioned, but there is no discussion of how to determine pitch. Presumably it is measured directly. (See FIG. 15 and col. 14, ll. 51-60). The Examiner cites FIG. 13 and col. 13, ll. 4-36, but that discussion is irrelevant to pitch. (Office Action, p. 5). Since Furukawa et al. fails to cure these deficiencies in Sasaki et al., claims 4, 13, 22 and 18 are allowable over the recited

combination.

Claims 5, 14, 23 and 29 are amended. For example, claim 5 describes a controller that identifies a moving object that is approaching a predicted path of the vehicle by grouping those extracted pixels having a same velocity component with the movement direction being from a side toward the predicted path of the vehicle and that generates a collision danger signal indicative of a risk of collision between the vehicle and the moving object. Similar features are included in claims 14, 23 and 29. Applicant respectfully submits that the cited references fail to teach or suggest identifying a moving object by grouping the pixels as claimed.

With respect to claim 6, 15, 23 and 29, pitch angle, among other things, is used to transform the oblique lines into a real space road model in Sasaki et al. However, the risk of collision between the vehicle and a moving object is not based on the relative positional relationship between the road boundary and the moving object as established in the real space road model. Instead, the moving object is assessed based on its optical flow, which indicates its relationship to the FOE, distance from the vehicle and the relative speed of the vehicle and object. (Col. 16, line 61- col. 17, line 4). The Examiner cites col. 9, ll. 15 and 51-64, but these sections of Sasaki et al. say nothing about, *inter alia*, the relative positional relationship between the road boundary and the moving object as established in a real space road model. Since Furukawa et al. fails to cure these deficiencies in Sasaki et al., these claims are allowable over the recited combination.

Applicant acknowledges that Sasaki et al. generates a warning to the driver. (Office Action, p. 6). This is, however, not what is <u>claimed</u> in dependent claims 7, 16, 24 and 30. Applicant submits that there is no teaching or suggestion of <u>a plurality of values corresponding to collision risk levels</u> as described therein. Only one value N is calculated at a time to make the determination of whether to issue a warning based on system and environmental conditions. (Col. 17, line 5- col. 18, line 25). Further, claim 24 describes risk avoidance means for controlling the vehicle to avoid a collision between the vehicle and the moving object according to the degree of risk assessed by the degree of collision danger judgment means and claim 30 describes generating a signal to control the vehicle to avoid a collision between the vehicle and the moving object according to the collision danger

judgment. Sasaki et al. fails to teach or suggest controlling the vehicle in any way in response to a collision danger. Instead, Sasaki et al. merely signals the driver to take action. Furukawa et al. fails to cure these deficiencies in Sasaki et al., so claims 7, 16, 24 and 30 are allowable over the recited combination.

Finally, contrary to the Examiner's position (Office Action, p. 7), Sasaki et al. does not teach or suggest an automatic braking device operatively coupled to the controller and activated by a collision danger signal as required by claims 9 and 18. In Sasaki et al., the word "brake" is never used, and "braking" is described only in the context of describing action by another driver that might cause a collision. (Col. 1, line 25). The Examiner cites col. 18, ll. 29-37, but this section merely states that a warning is given to attract the driver's attention. This deficiency is not cured by the addition of Furukawa et al. to the combination because Furukawa et al. also fails to teach or suggest the claimed feature. Claims 9 and 18 are allowable over the Examiner's combination.

It is submitted that this Amendment has antecedent basis in the Application as originally filed, including the specification, claims and drawings, and that this Amendment does not add any new subject matter to the Application. Consideration of the Application in view of these comments is requested. It is submitted that the Application is in suitable condition for allowance; notice of which is requested.

If the Examiner feels that prosecution of the present application can be expedited by way of an Examiner's amendment, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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